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**WO 03/044146 A1**

(54) Title: **TOUCHLESS WHEEL AND TIRE CLEANER AND METHODS OF APPLICATION**

(57) Abstract: An aqueous wheel and/or tire cleaning solution for removing the dirt from the surface of aluminum, chrome, stainless steel, painted steel, painted aluminum, clear coated aluminum, rubber, and plastic wheels and tires without scrubbing by applying the cleaning solution to the wheel and/or tire then rinsing the wheel and/or tire with water. Selected polymers include a polyvinylpyrrolidone, a poly(N-vinylimidazole), a poly(4-vinylpyridine-betaine), and/or a poly(4-vinylpyridine-N-oxide) each one of which can be used with conventional wheel cleaning components such as an acid or alkaline-based cleaning formulation to dramatically improve its cleaning power. These polymers can attach to organic and inorganic dirt particles forming a complex with them for easy removal from the wheel and/or tire during rinsing, leaving the wheel and/or tire clean without scrubbing the wheel or tire surface.

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**TOUCHLESS WHEEL AND TIRE CLEANER AND METHODS OF APPLICATION**

This application claims priority from United States Provisional Application Serial No. 60,333,279 filed on November 16, 2001.

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**Background of the Invention****Technical Field**

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This invention relates to an automotive wheel and/or tire cleaning composition for removing the dirt normally found on wheels and/or tires by spraying on and hosing off with water without scrubbing the wheel and/or tire surface.

**Description of the Prior Art**

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Since an automobile is a significant personal investment, many people like to keep their automobiles clean and shiny with a minimum amount of effort, to help maintain the value of their investment. The wheels and tires are part of the automobile that requires regular washing and cleaning to maintain the best appearance. There are various designs of wheels and some of those designs have areas that are hard to reach during the cleaning process. In order to help speed up the automobile cleaning process, there is a need for a wheel/tire cleaner that can clean the wheel/tire by spraying on the cleaner, and then rinse the dirt off with water, resulting in a clean wheel/tire without scrubbing or even touching the wheel and/or tire surface.

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This invention relates to an automotive wheel/tire cleaning composition for removing the dirt normally found on wheel/tires by spraying on and hosing off with water without scrubbing the wheel/tire surface. Since the wheel/tire is mounted on an automobile and encounters a variety of environmental conditions,

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the dirt that accumulates on the wheel/tires, is a combination of road soil and brake dust. Road soil is a complicated composition that can vary from location to location. Road soil can be divided into organic, which includes mineral oil, vegetable oil, animal fat, etc. and inorganic, which includes dust, dirt and other minerals. Brake dust is an accumulation of very fine particulates of carbon black, graphite, metal, etc. that is the residue from the brake pad wearing on the brake disk. The basic composition of brake pads is polymer resins, inorganic fillers, metal particles, etc. Brake pad compositions are guarded secrets by manufacturers and vary by type of resin, fillers, metals and ratios depending on the intended service. Because of the complexity of road soil and brake dust, the material to be cleaned from each vehicle wheel/tire varies every time it is cleaned. Another factor that needs to be considered for cleaning wheel is the material of construction of the wheel. This will affect the bonding force between the dirt and the wheel/tire, which impacts the cleaning performance. In general, the bond between the dirt and the wheel/tire surface is not permanent and the basic type of affinity is Van de Waal force, hydrogen bonding, static electricity, etc.

There are varieties of wheel/tire cleaners on the market, which are either acid or alkaline formulations. However, these products still have cleaning deficiency issues when they are sprayed on and hosed off. The concept of traditional cleaning detergent is to use lipophilic chain of surfactants to adhere and penetrate the soil layer then detach soil from the wheel/tire surface. In these typical cleaning detergent formulations, builders are used to help surfactants remove dirt and enhance surfactant performance on soil removal. Chelating agents such as ethylenediaminetetraacetic acid ('EDTA') are used to complex with metal ions to improve cleaning efficiency. However, the cleaning power is still not strong enough to remove all the dirt when these cleaners are sprayed on and hosed off.

For example, a wheel cleaning formulation is taught in U.S.

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Patent No. 5,733,377 which discloses the use of an acid fluoride salt in wheel cleaning formulations to enhance the cleaning performance. The acid fluoride salt can present a hazardous issue in that it can in some cases result in toxicity of the formulation.

## SUMMARY OF THE INVENTION

The cleaning composition of the instant invention is formulated specifically for wheel/tires which are fabricated from materials which may be susceptible to damage from corrosive products; however, all of the compositions set forth in the instant application cleans tires as well.

The present invention provides an aqueous wheel and tire cleaning solution for removing the dirt from the surface of aluminum, chrome, stainless steel, painted steel, painted aluminum, clear coated aluminum and plastic wheels, and/or rubber tires without scrubbing by applying the cleaning solution to the wheel/tire then rinsing the wheel/tire with water. Moreover, the solution may be used on hubcaps or other vehicle exterior parts such as chrome grills, painted fiberglass, rubber, and painted elastomer and plastic bumpers as well. Preferred polymers utilized in the present invention are selected from a polyvinylpyrrolidone, a poly(4-vinylpyridine-betaine), a poly(N-vinylimidazole, a poly(4-vinylpyridine-N-oxide) and combinations thereof together with at least one surfactant. The selected polymer(s) and surfactant(s) can be combined with conventional wheel cleaning components such as an acid or alkaline-based formulation. The composition of the instant invention dramatically improves wheel cleaning power without pitting, etching, or hazing the surface of the wheel. After application and removal in a reasonable time period in accordance with the directions on the container.

The present invention uses this dye transfer concept by using polymers to attach to dirt particles and complex it with the polymers for easy removal. These complexed dirt particles

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can then be easily removed from the wheel/tire during rinsing leaving the wheel/tire clean without scrubbing the wheel/tire surface.

5 A novel feature of the instant invention is the use of a polymer selected from a polyvinylpyrrolidone, a poly(4-vinylpyridine-betaine), an alkylated polyvinylpyrrolidone, a poly(N-vinylimidazole, and a poly(4-vinylpyridine-N-oxide) and combinations thereof, together with one or more selected surfactants. Other conventional wheel cleaners such as EDTA and/or sodium metasilicate may be used together with the selected  
10 polymer(s) and surfactant(s). Also, an alkaline-based formulation may be used with the polymer and surfactant and/or other above mentioned ingredients to provide an improved wheel cleaning product. These polymers have been used in the laundry  
15 industry to provide dye transfer inhibition benefits. In laundering operations, some colored fabrics have a tendency to release dye into the laundering solutions and the dye can then be transferred onto other fabrics being washed in the same aqueous washing solution. In order to resolve this dye transfer  
20 issue, these polymers are used to adsorb the fugitive dyes and complex them before they transfer to other fabrics.

The present invention uses this dye transfer concept by using selected polymers to attach to dirt particles and complex it with the polymers for easy removal. These complexed dirt  
25 particles can then be easily removed from the wheel/tire during rinsing leaving the wheel/tire clean without scrubbing the wheel/tire surface.

It is an object of the present invention to provide a cleaning solution which can be used by itself or combined with  
30 existing conventional cleaners to remove dirt, brake residue, and road grime from wheel/tire surfaces by application to the wheel/tire by spraying or wiping with a cloth or sponge and simply rinsing the wheel/tire cleaner from the wheel/tire surface with water.

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It is an object of the present invention to provide a cleaning solution which is effective without requiring scrubbing.

It is a further object of the present invention to provide a wheel/tire cleaner which is effective and does not leave an insoluble residue.

It is another object of the present invention to provide a wheel/tire cleaning solution which can be used on aluminum, chrome, steel wheels, and painted wheels without damaging the surface.

It is another object of the present invention to provide a cleaning composition in a concentrate which can be further diluted to a 1:3 ratio with water for application to the wheel/tire or other surface to be cleaned therewith.

These are other objects and features of the invention will become apparent to those skilled in the art from the following detailed description and appended claims.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

The active ingredients of the present invention are polymers selected from the group comprising a polyvinylpyrrolidone, poly(4-vinylpyridine-betaine), poly(N-vinylimidazole, and/or poly(4-vinylpyridine-N-oxide) alone or together, in combination with conventional wheel cleaners, such as an acid or alkaline-based formulation, and/or detergents, and/or organic solvents to dramatically improve its wheel/tire cleaning power. The polymers complex with the organic or inorganic soil matter and the detergents and/or solvents dissolve and emulsify the soil particles. It is noted that the term solvent is used to describe an additive which may be used to enhance the cleaning formula's ability to dissolve dirt or other residue on the wheel/tire such as asphalt tire or gum; however, the solvent is not necessary to dissolve the polymers or other ingredients of the instant invention in the solution.

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The polyvinylpyrrolidone, ('PVP') polymers are available in low medium and high molecular weights. The PVP polymers selected for the instant invention are linear, nonionic polymers having amphiphillic characteristics, and are soluble in water and polar solvents. PVP polymers can be obtained from International Specialty Products. A preferred low molecular weight PVP is available under the trade name of PVP K-15 which has a K-value (viscosity of 1% solution) of 13-19 and a molecular weight in the range of from between 6,000- 15,000. A preferred medium molecular weight PVP is available under the trade name of PVP K-30 which has a K-value (viscosity of 1% solution) of 26-35 and a molecular weight in the range of from between 40,000 - 80,000. Another preferred medium molecular weight PVP is available under the trade name of PVP K-60 which has a K-value (viscosity of 1% solution) of 50-62 and a molecular weight in the range of from between 240,000- 400,000. A preferred high molecular weight PVP is available under the trade name of PVP K-90 which has a K-value (viscosity of 1% solution) of 88-100 and a molecular weight in the range of from between 900,000- 1,500,000. Another preferred high molecular weight PVP is available under the trade name of PVP K-120 which has a K-value (viscosity of 1% solution) of 108-130 and a molecular weight in the range of from between 2,000,000-3,000,000.

Alkylated polyvinylpyrrolidone, ('PVP') polymers also are effective dirt complexing polymers. International Specialty Products sells alkylated PVPs' under the trade name of GANEX. The alkylated PVP have a relatively low molecular weight and vary in the degree of hydrophobicity. The alkylated PVPs is a copolymer produced from  $\alpha$ -olefins and vinyl pyrrolidone. The alkyl component varies from a C-4 to C-30 moiety, in concentrations from 10 to 80 percent. For instance GANEX P-904L is a alkylated PVP copolymer consisting of 90% vinyl pyrrolidone and 10% of a C<sub>4</sub>  $\alpha$ -olefins (1-butene). GANEX V-516 is a alkylated PVP copolymer consisting of 50% vinyl pyrrolidone and 50% of an C<sub>16</sub>  $\alpha$ -olefins (1-hexadecene). GANEX V-216 is a alkylated PVP

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copolymer consisting of 20% vinyl pyrrolidone and 80% of a C<sub>4</sub>  $\alpha$ -olefins (1-butene). GANEX V-220 is a alkylated PVP copolymer consisting of 20% vinyl pyrrolidone and 80% of an C<sub>20</sub>  $\alpha$ -olefins (1-eicosene). GANEX V-660 is a alkylated PVP copolymer consisting of 20% vinyl pyrrolidone and 80% of an C<sub>30</sub>  $\alpha$ -olefins (1-tricosene).

The poly(4-vinylpyridine-N-oxide, ('PVNO')), is more particularly a poly vinyl pyridine-N-oxide, ('PVNO'), is (4-ethenylpyrine, homopolymer, N-oxide) in an aqueous solution. The PVNO is available commercially and distributed in solid form and 40% aqueous solution. The 40% aqueous solution product of PVNO (product containing 40% active ingredient in a water solution), is used in an amount of up to 40% weight by weight, (w/w), level due to commercial cost feasibility, but is not limited to that amount. Experiments with the compound were conducted using levels equivalent to 100% (w/w). The concentrated solution level of a preferred embodiment of the cleaning solution containing the PVNO is effective to attach to dirt particles and form a complex it with it for easy removal in an amount which is soluble in water and is typically prepared in a concentration of the polymer solid of up to 10.0% and more preferably in a range of from about 0.01 to 5.0% and more preferably in an amount of from between 0.05 to 2.0% (w/w).

The poly(4-vinylpyridine-betaine) is also described as a poly(N-carboxymethyl-4-vinylpyridinium chloride) sodium salt in water having a molecular formula of  $[[C_5H_7O_2N].NaCl]_x$ . It is an acetic acid, chloro-, sodium salt compound with 4-ethenylpyridine homopolymer. It is also soluble in water and water/alcohol mixtures. A preferred embodiment has a molecular weight range of from between 15,000 and 200,000 (GPC). It is typically used as a dye transfer inhibitor and is a vinylpyridine derivatized with carboxylate functionally to give repeating units of a betaine salt. The concentrated solution level of a preferred embodiment of the cleaning solution containing the PVP betaine is effective in an amount which is soluble in water and is

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typically prepared in a concentration of the polymer solid of up to 10.0% and more preferably in a range of from about 0.01 to 5.0% and more preferably in an amount of from between 0.05 to 2.0% (w/w).

5           Various formulations were provided for purposes of illustrating the invention. It should be understood that these examples are for illustrative purposes only and are not to be constructed as limiting the scope of the invention in any manner. Table 1 shows various wheel/tire cleaning compositions utilizing  
10 one or more of the aforementioned selected polymers according to the formulations set forth in Example 1 and 2, and their efficiency of cleaning power as compared to two leading commercial products containing detergents.

15           (Preparation of Wheel/tire Cleaning Compositions)

Wheel/tire cleaning compositions were prepared in a routine manner, generally using the following general procedure. De-ionized water was added to a glass beaker with a magnetic  
20 stirrer. With the mixer running, each ingredient was added into the mixture. While order of addition of ingredient is not believed to be critical, the surfactants were added last. Each ingredient was allowed to become completely dispersed prior to the addition of the next ingredient. After the addition of the  
25 final ingredient, the mixture is allowed to stir for a period of up to 15 minutes and preferably at least 5 minutes to ensure a homogeneous mixture.

(Cleaning Performance of Various Wheel/tire Cleaning  
Compositions)

30           Prior to use in the examples a preferred embodiment of the instant cleaning solution product has a concentration of polymer in an effective amount to attach to dirt particles and form a complex with it for easy removal is up to 10.0% (w/w) and more

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preferably from .01 to 5.0% (w/w) and more preferably in a range of from .05 to 2.0% (w/w), and more preferably in a range of from .2 to 1.3% (w/w) as set forth in Table 1. All units are in grams.

5           Cleaning effectiveness was evaluated by the following method. Each formulation was applied to a dirty wheel/tire using a trigger sprayer and saturating the entire surface. The compositions were allowed to soak for one (1) minute at room temperature without any scrubbing. The wheel/tire was then  
10   rinsed with water at normal household water pressure. After rinsing, the wheel/tire surfaces were visually evaluated for cleanness of the wheel/tire. Each cleaning composition was rated on a scale of 1 (no dirt removal) to 5 (complete dirt removal). Three control formulations were also included. The Control 1  
15   concentrate represents a formulation without polymers. Commercial Test Product 1 is an acid base cleaning product, and Commercial Test Product 2 is also an acid based cleaning product. Commercial Test Products 1 and 2 represent the current most popular wheel cleaning products on the market.

20           It should be noted that for test purposes the solution was allowed to remain on the wheel/tire for one minute; however, this time period is not critical, for depending upon the condition of the wheel/tire to be cleaned, the solution can be effective in a matter of seconds and be rinsed off immediately after  
25   application. Although the solution could be allowed to remain on the wheel/tire for several minutes, for instance up to five minutes, typically within at least thirty seconds the cleaning composition has dissolved the dirt and is ready for rinsing.

30           Table 1 lists the components of some of the formulations tested in accordance with the above method. The cleaning ability of each formula was rated on a scale of 1 to 5 with 5 indicating excellent cleaning, and 1 indicating no or little  
cleaning.

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TABLE I

	Ingredients	A	B	C	D	E	Ctrl 1	Acid base Samp	Acid base Samp
								2	3
	Water	87. 0	87. 0	87. 0	87. 0	87. 0	88.0	Co mm er ci al pr od uc t 1	Co mm er ci al pr od uc t 2
	Sodium EDTA	2.0	2.0	2.0	2.0	2.0	2.0		
5	Na Metasilicate Pentahydrate	3.0	3.0	3.0	3.0	3.0	3.0		
	Non-ion/cationic surfactants	7.0	7.0	7.0	7.0	7.0	7.0		
10	Polyvinylpyrrolidone (low mwt. 6,000- 15,000)	1.0							
	Polyvinylpyrrolidone (mid. mwt. 40,000- 80,000)		1.0						
15	Polyvinylpyrrolidone (high mwt. 900000- 1500000)			1.0					
	Poly(4-vinylpyridine betaine)				1.0				
20	Poly(4-vinylpyridine- N-oxide)					1.0			
	CLEANING RATING	5.0	5.0	4.0	5.0	5.0	2.0	2.0	3.0

The results indicate that all of the cleaning solutions containing the selected polymers PVP polymers and derivatives thereof in effective amounts as set forth in Table 1 are superior to the results of the control without the polymer and both of the leading commercial products 1 and 2 which do not contain the

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selected PVP polymers.

Additional conventional cleaning additives such as a ( $C_8-C_{12}$ ) quaternary ammonium compound ( $Cl^-$ ) and amphoterics can be used in the formulation such as lauroamphoglycerinatees, betaines, and the like.

Sodium metasilicate anhydrous and/or other silicates can be added to the composition alone or in combination as a scouring agent. Typically the silicates are added to the formulation in effective amounts which enhance cleaning without pitting the surface of levels up to 10 percent by weight and preferably at levels of from 0.1 to 5 percent by weight and more preferably in levels from 2 to 4 percent by weight.

Moreover, various emulsifiers and dispersing agents can be used such as phosphates, and more particularly such as a tripolyphosphate, a trisodium phosphate, acid phosphates such as mono and disodium phosphates and sodium acid pyrophosphate, and/or a tetrapotassium pyrophosphate, and/or combinations thereof can be used with or in place the sodium metasilicate anhydrous or other silicates in combination with the polymers set forth herein to obtain an alternate embodiment of the present invention. The phosphates and other emulsifiers such as sodium citrate are typically used in effective amounts of up to 10 percent by weight, and more preferably from about 0.1 to 5 percent by weight.

In addition to the above-mentioned PVP compounds, it is anticipated that chloride in the form of quaternary ammonium compounds having a formulation with a  $Cl^-$  and containing from 8 to 12 carbons can also be utilized as a preferred cleaning composition.

Compounds useful in the present invention include those of which  $R$  is the linear primary alcohol and  $n$  is the total number of moles of ethylene oxide in accordance with the following

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formula:



Wherein R comprises a:

Linear C<sub>8</sub> C<sub>9</sub> C<sub>10</sub> C<sub>11</sub> C<sub>12</sub> Poly(2) or (4) or (6) or (8)  
 5 oxyethylene C<sub>8-12</sub> alcohol;

Linear C<sub>9</sub> C<sub>10</sub> C<sub>11</sub> Poly(2.5) or (6) or (8) oxyethylene C<sub>9-11</sub>  
 alcohol;

Linear C<sub>11</sub> Poly(3) or (5) or (7) oxyethylene C<sub>11</sub> alcohol;

Linear C<sub>12</sub>/C<sub>13</sub> Poly(1) or (3) or (5) or (6.5) oxyethylene C<sub>12-13</sub>  
 10 alcohol;

Linear C<sub>12</sub> C<sub>13</sub> C<sub>14</sub> C<sub>15</sub> Poly(3) or (7) or (9) or (12) oxyethylene  
 C<sub>12-15</sub> alcohol; and/or

Linear C<sub>14</sub>/C<sub>15</sub> Poly(2.5) or (7) or (13) oxyethylene C<sub>14-15</sub>  
 alcohol.

15 Moreover, amine oxides, nonyl phenol ethoxylate, ethoxylated  
 alcohols, ethoxylate propoxylated block co-polymers and  
 diethanolamides may be used in the present invention as  
 surfactants.

It is also contemplated that the aforementioned polymers  
 20 ((polyvinylpyrrolidone, poly(4-vinylpyridine-betaine), poly(N-  
 vinylimidazole, alkylated polyvinylpyrrolidone and/or poly(4-  
 vinylpyridine-N-oxide) alone or together can be combined with an  
 acid or alkaline based cleaning formulation.

Acid cleaners which may be used together with the polymers  
 25 of the instant invention and include acids such as phosphoric,  
 hydrochloric, sulfuric, oxalic, acetic, nitric, hydroxyacetic,  
 hydrofluoric, and citric acids and combinations thereof.

Alkaline cleaners which may be used together with the  
 polymers of the instant invention include detergents, water  
 30 soluble organic solvents such as glycol ether, alkaline

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compositions such as sodium hydroxide, potassium hydroxide, and /or any of the alkaline silicates and phosphates.

Suitable detergents capable of dissolving and emulsifying organic soils include, but are not limited to anionic synthetic detergents such as alkyl sulfates such as sodium lauryl sulfate, alkyl ether sulfates, and linear alkyl benzene sulfonates. The amount of detergents used in the composition is not critical so long as it remains soluble in an aqueous solution and is capable of dissolving and emulsifying organic soils. The amount of detergent used typically depends on the amount used. For example, nonionic detergents can be used in amounts of up to 40 percent by weight. Anionic synthetic detergents can be used in amounts up to 30 percent by weight.

Organic solvents which can be used in with the polymers of the instant invention include, but are not limited to glycols such as ethylene and propylene glycol, glycol ethers, hydrocarbons, alcohols, n-methyl pyrrolidone, ketones, lactones, and terpenes such as d-limonene. The organic solvents can be used in amounts of up to 50% by weight.

Chelating agents such as ethylenediaminetetraacetic acid ('EDTA') such as sold by the trade name VERSENE 100 may be used to aid in the removal of insoluble deposits of calcium and magnesium soaps and/or as a scouring agent. Moreover a number of salts of EDTA sometimes referred to as edetates are available such as calcium disodium, disodium edetates, tetrasodium, trisodium sodium ferric, dihydrogen ferrous and other disodium salts containing magnesium, cobalt manganese, copper, zinc, and nickel.

Cationic and nonionic surfactants such as BEROL 226 by Akzo Nobel Chemicals which is a combination of at least one cationic and at least one nonionic surfactants, and PLUROFAC D25 can be utilized in the present formulation in effective amounts of up to 20 percent by weight, and more preferably in amounts from .01

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to 10.0 percent and more preferably from .1 to 5.0 percent.

A viscosity thickener such as ELFACOS CD481 (1%) can be utilized in the present formulation in effective amounts of up to 10 percent by weight.

5        A scouring agent such as sodium metasilicate pentahydrate, sodium metasilicate anhydrous, silicates can be incorporated into the instant composition in effective amounts of up to 10 percent by weight, and more preferably in amounts from .01 to 5.0 percent and more preferably from .1 to 3.0 percent.

10        Dispersing agents and emulsifiers such as a trisodium phosphate, a tetrapotassium pyrophosphate, sodium tripolyphosphate, sodium citrate, and acid phosphates such as mono and disodium phosphate and sodium acid pyrophosphate  
15        compounds can be used in effective amounts of up to 10 percent by weight, and more preferably in amounts from .01 to 5.0 percent and more preferably from .1 to 3.0 percent.

BITREX or other additives may be added to the formulation in an effective amount to add a bitter taste to the composition.

20        Terpenes such as limonene may be added in an effective amount to enhance the fragrance of the product.

The following examples utilize the polymers of the present invention together with conventional cleaning constituents.

### Example 3

25        (Cleaning Performance of Various Wheel/tire Cleaning Compositions)

<u>Component</u>	<u>Weight in Grams</u>
PVP (10% solution)	8.64
Water	68.86
30. VERSEN 100 (EDTA)	3.20
Sodium Metasilicate Pentahydrate	2.4

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BEROL 226 (Surfactant)	7.2
Isopropyl Alcohol	4.9

The composition set forth in Example 3 resulted in a clean wheel/tire without residue.

5

**Example 4**

(Cleaning Performance of Various Wheel/tire Cleaning Compositions)

	<u>Component</u>	<u>Weight in Grams</u>
	PVP (10% solution)	1.08
10	Water	76.92
	VERSEN 100 (EDTA)	4.0
	Sodium Metasilicate Pentahydrate	3.0
	BEROL 226 (Surfactant)	9.0
	Isopropyl Alcohol	6.0

15

The composition set forth in Example 4 resulted in a clean wheel/tire, but the results were not as good as those with the formulation of Example 3.

**Example 5**

(Cleaning Performance of Various Wheel/tire Cleaning Compositions)

20

	<u>Component</u>	<u>Weight in Grams</u>
	PVP (10% solution)	8.64
	Water	73.76
	VERSEN 100 (EDTA)	3.2
25	Sodium Metasilicate Pentahydrate	2.4
	BEROL 226 (Surfactant)	7.2

The composition set forth in Example 5 resulted in a clean wheel/tire without residue indicating that the addition of ~~isopropyl-alcohol has a negligible effect if any on the final~~ products at the levels used in Example 3.

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**Example 6****(Cleaning Performance of Various Wheel/tire Cleaning Compositions)**

	Component	Weight in Grams
5	PVNO (40% solution)	2.5
	Water	67.2
	VERSEN 100 (EDTA)	4.0
	Sodium Metasilicate Pentahydrate	3.0
	BEROL 226 (Surfactant)	9.0
10	Elfacos CD481 (1%) viscosity thickener	5.0

The composition set forth in Example 6 exhibited very good cleaning power.

**Example 7****(Cleaning Performance of Various Wheel/tire Cleaning Compositions)**

	<u>Component</u>	<u>Weight in Grams</u>
15	PVNO (40% solution)	0.6
	Water	85.4
	VERSEN 100 (EDTA)	4.0
20	Sodium Metasilicate Pentahydrate	3.0
	BEROL 226 (Surfactant)	7.0

The composition set forth in Example exhibited very good cleaning power and is equivalent to that in Example 3.

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## Example 8

(Cleaning Performance of Various Wheel/tire Cleaning  
Compositions)

	<u>Component</u>	<u>Weight in Grams</u>
5	PVP (10% solution)	2.5
	Water	67.2
	VERSEN 100 (EDTA)	4.0
	Sodium Metasilicate Pentahydrate	3.0
	BEROL 226 (Surfactant)	9.0
10	Elfacos CD 481 (1%)	5.0

The composition set forth in Example 8 resulted in a clean wheel/tire without residue.

## Example 9

(Cleaning Performance of Various Wheel/tire Cleaning  
Compositions)

	<u>Component</u>	<u>Weight in Grams</u>
15	PVP (10% solution)	0.6
	Water	85.4
	VERSEN 100 (EDTA)	4.0
20	Sodium Metasilicate Pentahydrate	3.0
	BEROL 226 (Surfactant)	7.0

The composition set forth in Example 9 resulted in a clean wheel/tire.

25 The foregoing detailed description is given primarily for clearness of understanding and no unnecessary limitations are to be understood therefrom, for modification will become obvious to those skilled in the art upon reading this disclosure and may

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be made upon departing from the spirit of the invention and scope of the appended claims. Accordingly, this invention is not intended to be limited by the specific exemplifications presented herein above. Rather, what is intended to be covered is within  
 5 the spirit and scope of the appended claims.

### CLAIMS

We claim:

Claim 1. A cleaning composition, comprising an effective amount of a dirt complexing polymer selected from the group  
 10 consisting of a polyvinylpyrrolidone, a poly(4-vinylpyridine-betaine), a poly(N-vinylimidazole, a poly(4-vinylpyridine-N-oxide), and combinations thereof; and  
 at least one surfactant.

Claim 2. The cleaning composition of claim 1, wherein said  
 15 surfactant is a nonionic surfactant, a cationic surfactant, and combinations thereof.

Claim 3. The cleaning composition of claim 1, wherein said surfactant is selected from the group consisting of BEROL 226, PLUROFAC D25, and combinations thereof.

Claim 4. The cleaning composition of claim 1, including a including a quaternary ammonium compound containing from 8 to 12 carbons of which R is the linear primary alcohol and n is the total number of moles of ethylene oxide in accordance with the formula  $RO(CH_2CH_2O)_nH$  wherein R is selected from the group  
 20 consisting of a  
 linear  $C_8$ ,  $C_9$ ,  $C_{10}$ ,  $C_{11}$ ,  $C_{12}$  Poly(2) or (4) or (6) or (8) oxyethylene  $C_{8-12}$  alcohol; linear  $C_9$ ,  $C_{10}$ ,  $C_{11}$  Poly(2.5) or (6) or (8) oxyethylene  $C_{9-11}$  alcohol; linear  $C_{11}$  Poly(3) or (5) or (7) oxyethylene  $C_{11}$  alcohol; linear  $C_{12}/C_{13}$  Poly(1) or (3) or (5) or (6.5) oxyethylene  $C_{12-13}$   
 25 alcohol; linear  $C_{12}-C_{13}-C_{14}-C_{15}$  Poly(3) or (7) or (9) or (12) oxyethylene  $C_{12-15}$  alcohol; and linear  $C_{14}/C_{15}$  Poly(2.5) or (7) or  
 30 alcohol; and linear  $C_{14}/C_{15}$  Poly(2.5) or (7) or

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(13) oxyethylene C<sub>14-15</sub> alcohol.

Claim 5. The cleaning composition of claim 1, including a compound selected from the group consisting of an amine oxide, a nonyl phenol ethoxylate, an ethoxylated alcohol, and ethoxylate propoxylated block co-polymer, and a diethanolamide.

Claim 6. The cleaning composition of claim 1, including a conventional cleaning agent comprising an acid-based formulation.

Claim 7. The cleaning composition of claim 6, including wherein said acid-based formulation includes an acid cleaner selected from the group consisting of a phosphoric, a hydrochloric, a sulfuric, an oxalic, an acetic, a nitric, a hydroxyacetic, a hydrofluoric, a citric acid, and combinations thereof.

Claim 8. The cleaning composition of claim 1, including a conventional cleaning agent comprising an alkaline-based formulation.

Claim 9. The cleaning composition of claim 8, including an effective amount of an alkaline cleaner capable of dissolving and emulsifying organic soils selected from the group consisting of a detergent, a water soluble organic solvent, a glycol ether, a sodium hydroxide solution, a potassium hydroxide solution, an alkaline silicate, an alkaline phosphate, and combinations thereof.

Claim 10. The cleaning composition of claim 9, wherein said detergent is an anionic synthetic detergent.

Claim 11. The cleaning composition of claim 10, wherein said anionic synthetic detergent is an alkyl sulfate.

~~Claim 12. The cleaning composition of claim 11, wherein said alkyl sulfate is selected from the group consisting of a~~

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sodium lauryl sulfate, an alkyl ether sulfate, a linear alkyl benzene sulfonate, and combinations thereof.

5 Claim 13. The cleaning composition of claim 9, wherein the amount of said alkaline cleaner is not critical so long as it remains soluble in an aqueous solution and is capable of dissolving and emulsifying organic soils.

Claim 14. The cleaning composition of claim 9, wherein said alkaline cleaner is present in an amount of to 40 percent by weight.

10 Claim 15. The cleaning composition of claim 1, including an organic solvent in an amount of to 50% by weight.

15 Claim 16. The cleaning composition of claim 15, wherein said organic solvents are selected from the group consisting of an ethylene glycol, a propylene glycol, a glycol ether, a hydrocarbon, an alcohol, a n-methyl pyrrolidone, a ketone, a lactone, a terpene, and combinations thereof.

Claim 17. The cleaning composition of claim 16, wherein said terpene is a limonene.

20 Claim 18. The cleaning composition of claim 1, including a chelating agent for aiding in the removable of insoluble deposits of calcium and magnesium soaps and salts thereof.

Claim 19. The cleaning composition of claim 18 wherein said chelating agent is ethylenediaminetetraacetic acid ('EDTA') and salts thereof.

25 Claim 20. The cleaning composition of claim 19, wherein said salts of EDTA are selected from the group consisting of calcium disodium edentate, disodium edentate, tetrasodium edentate, ~~trisodium~~ sodium ferric edentate, ~~dihydrogen ferrous~~ edentate.

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Claim 21. The cleaning composition of claim 18 wherein said chelating agent comprises a disodium salts of magnesium, cobalt, manganese, copper, zinc, and nickel.

5 Claim 22. The cleaning composition of claim 2 wherein said cationic surfactant, said nonionic surfactant, or said combination thereof is present in an amount of up to 20 percent by weight.

10 Claim 23. The cleaning composition of claim 2 wherein said cationic surfactant, said nonionic surfactant, or said combination thereof is present in an amount of up to 0.01 to 5.0 percent by weight.

Claim 24. The cleaning composition of claim 1 including a scouring agent.

15 Claim 25. The cleaning composition of claim 1, wherein said scouring agent is selected from the group consisting of sodium metasilicate pentahydrate, sodium metasilicate anhydrous, and silicates.

20 Claim 26. The cleaning composition of claim 25 wherein said scouring agent is present in an amount of up to 10 percent by weight.

Claim 27. The cleaning composition of claim 25 wherein said scouring agent is present in an amount of from between 0.01 and 5.0 percent by weight.

25 Claim 28. The cleaning composition of claim 1 including a dispersing and emulsifying agent.

Claim 29. The cleaning composition of claim 1 wherein said dispersing and emulsifying agent is selected from the group consisting of trisodium phosphate, tetrapotassium pyrophosphate, sodium tripolyphosphate, sodium citrate, monosodium phosphate,

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disodium phosphate, sodium acid pyrophosphate, and combinations thereof.

Claim 30. The cleaning composition of claim 29 wherein said dispersing and emulsifying agent is present in an amount of to  
5 10.0 percent by weight.

Claim 31. The cleaning composition of claim 29 wherein said dispersing and emulsifying agent is present in an amount of between .01 to 5.0 percent by weight.

Claim 32. The cleaning composition of claim 1 including a  
10 effective amount of a compound to effect a bitter taste to the composition.

Claim 33. The cleaning composition of claim 32 wherein said compound to effect a bitter taste to the composition is BITREX.

Claim 34. The cleaning composition of claim 1 including a  
15 viscosity thickener.

Claim 35. The cleaning composition of claim 34 wherein said viscosity thickener is present in an amount of up to 5.0 percent by weight.

Claim 36. The cleaning composition of claim 1, wherein said  
20 viscosity thickener is ELFACOS CD481 (1%).

Claim 37. The cleaning composition of claim 1, wherein said polyvinylpyrrolidone comprises a molecular weight in the range of from between 6,000- 15,000.

Claim 38. The cleaning composition of claim 1, wherein  
25 said polyvinylpyrrolidone comprises a molecular weight in the range of from between 40,000 - 80,000.

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Claim 39. The cleaning composition of claim 1, wherein

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said polyvinylpyrrolidone comprises a molecular weight in the range of from between 240,000- 400,000.

5 Claim 40. The cleaning composition of claim 1, wherein said polyvinylpyrrolidone comprises a molecular weight in the range of from between 240,000 - 400,000.

Claim 41. The cleaning composition of claim 1, wherein said polyvinylpyrrolidone comprises a molecular weight in the range of from between 900,000 - 1,500,000.

10 Claim 42. The cleaning composition of claim 1, wherein said polyvinylpyrrolidone comprises a molecular weight in the range of from between 2,000,000 - 3,000,000.

15 Claim 43. The cleaning composition of claim 1, wherein said alkylated polyvinylpyrrolidone is selected from the group consisting of GANEX P-904L which is an alkylated PVP copolymer comprising 90% vinyl pyrrolidone and 10% of a C<sub>4</sub>  $\alpha$ -olefins (1-butene), GANEX V-516 which is a alkylated PVP copolymer comprising of 50% vinyl pyrrolidone and 50% of an C<sub>16</sub>  $\alpha$ -olefins (1-hexadecene, GANEX V-216 which is a alkylated PVP copolymer comprising 20% vinyl pyrrolidone and 80% of a C<sub>4</sub>  $\alpha$ -olefins (1-butene), GANEX V-220 which is an alkylated PVP copolymer comprising 20% vinyl pyrrolidone and 80% of an C<sub>20</sub>  $\alpha$ -olefins (1-eicosene), GANEX V-660 which is an alkylated PVP copolymer comprising 20% vinyl pyrrolidone and 80% of an C<sub>30</sub>  $\alpha$ -olefins (1-tricosene), and combinations thereof.

25 Claim 44. The cleaning composition of claim 1, wherein said poly(4-vinylpyridine-N-oxide is in a 40% aqueous solution, (product containing 40% active ingredient in a water solution).

30 Claim 45. The cleaning composition of claim 1, wherein said poly(4-vinylpyridine-betaine) has a molecular weight range of from between 15,000 and 200,000 (GPC).

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Claim 46. The cleaning composition of claim 1, including a cleaning additive selected from the group comprising lauroamphoglycerinatees and betaines.

5 Claim 47. The cleaning composition of claim 1, wherein said scouring agent is present in an amount of up to 10.0 percent by weight.

Claim 48. The cleaning composition of claim 1, wherein said scouring agent is present in an amount of up to 0.1 to 5.0 percent by weight.

10 Claim 49. The cleaning composition of claim 1, wherein an effective amount of said dirt complexing polymer is in a range of from between 0.01 to 10.0 percent (w/w).

Claim 50. The cleaning composition of claim 1, wherein said composition is diluted to a 1:3 ratio with water.

15 Claim 51. The cleaning composition of claim 1, wherein an effective amount of said dirt complexing polymer is present in a range of from between 0.01 to 5.0 percent (w/w).

20 Claim 52. The cleaning composition of claim 1, wherein an effective amount of said dirt complexing polymer is present in a range of from between 0.05 to 2.0 percent (w/w).

Claim 53. The cleaning composition of claim 52, whereby said cleaning composition can be further diluted to a 1:3 ratio with water for application to the wheel/tire or other surface to be cleaned therewith.

25 Claim 54. A cleaning composition comprising:  
an effective amount of a dirt complexing polymer selected from the group consisting of a polyvinylpyrrolidone, a poly(4-vinylpyridine-betaine), a poly(N-vinylimidazole), a poly(4-vinylpyridine-N-oxide), and combinations thereof;

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an effective amount of at least one surfactant;  
an effective amount of at least one scouring agent;  
and water.

5 Claim 55. The cleaning composition of claim 54, wherein  
said surfactant is BEROL 226 in an amount of from between 0.01  
to 20.0 percent by weight.

Claim 56. The cleaning composition of claim 54, wherein  
said scouring agent is sodium metasilicate pentahydrate in an  
amount of from between 0.01 and 10 percent by weight.

10 Claim 57. The cleaning composition of claim 54, wherein  
said solvent is an alcohol in an amount of up to 50 percent by  
weight.

15 Claim 58. The cleaning composition of claim 54, including  
a chelating agent for aiding in the removable of insoluble  
deposits of calcium and magnesium soaps and salts thereof.

Claim 59. The cleaning composition of claim 58 wherein said  
chelating agent is ethylenediaminetetraacetic acid ('EDTA') and  
salts thereof.

20 Claim 60. The cleaning composition of claim 59 wherein said  
chelating agent is VENSENE 100.

Claim 61. The cleaning composition of claim 54, including  
an effective amount of a solvent.

25 Claim 62. The cleaning composition of claim 61, wherein  
said solvent is selected from the group consisting of an  
ethylene glycol, a propylene glycol, a glycol ether, a  
hydrocarbon, an alcohol, a n-methyl pyrrolidone, a ketone, a  
lactone, a terpene, and combinations thereof.

Claim 63. The cleaning composition of claim 54, wherein an

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effective amount of said dirt complexing polymer is present in a range of from between 0.01 to 5.0 percent (w/w).

Claim 64. The cleaning composition of claim 54, wherein an effective amount of said dirt complexing polymer is present in  
5 a range of from between 0.05 to 2.0 percent (w/w).

Claim 65. The cleaning composition of claim 64, whereby said cleaning composition can be further diluted to a 1:3 ratio with water for application to the wheel/tire or other surface to be cleaned therewith.

10 Claim 66. A method of preparing a cleaning composition comprising the steps of:

preparing a solution of water or water and a polar solvent in a container;

agitating said solution;

15 selecting an effective amount of a dirt complexing polymer selected from the group consisting of a polyvinylpyrrolidone, a poly(4-vinylpyridine-betaine), a poly(N-vinylimidazole, a poly(4-vinylpyridine-N-oxide), and combinations thereof and adding same to said solution dispersing same;

20 adding a scouring agent to said solution dispersing same; adding a surfactant to said solution dispersing same; and agitating said solution obtaining a homogenous cleaning composition mixture.

Claim 67. The cleaning composition of claim 66, including  
25 the step of adding a chelating agent and dispersing same for aiding in the removable of insoluble deposits of calcium and magnesium soaps and salts thereof.

Claim 68. The cleaning composition of claim 67 wherein said chelating agent is ethylenediaminetetraacetic acid ('EDTA') and  
30 salts thereof.

Claim 69. A method of preparing a cleaning composition,

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comprising the steps of selecting an effective amount of a dirt complexing polymer selected from the group consisting of a polyvinylpyrrolidone, a poly(4-vinylpyridine-betaine), a poly(N-vinylimidazole, a poly(4-vinylpyridine-N-oxide), and combinations thereof and mixing said dirt complexing polymer together with an acid-based formulation in an aqueous solution.

Claim 70. The method of cleaning a wheel comprising the steps of:

applying a cleaning composition comprising an effective amount of a dirt complexing polymer selected from the group consisting of a polyvinylpyrrolidone, a poly(4-vinylpyridine-betaine), a poly(N-vinylimidazole, a poly(4-vinylpyridine-N-oxide), mixed together with a scouring agent, a surfactant, and a chelating agent, and combinations mixed together in an aqueous solution by spraying said cleaning composition onto a wheel or tire;

wiping with a cloth or sponge; and  
rinsing said wheel or tire with water.

Claim 71. The method of cleaning a wheel comprising the steps of:

applying a cleaning composition comprising an effective amount of a dirt complexing polymer selected from the group consisting of a polyvinylpyrrolidone, a poly(4-vinylpyridine-betaine), a poly(N-vinylimidazole, a poly(4-vinylpyridine-N-oxide), and combinations mixed thereof together with a conventional cleaning agent comprising an alkaline-based formulation in an aqueous solution by spraying said cleaning composition onto a wheel or tire;

waiting for 30 seconds; and  
rinsing said wheel with water.

Claim 72. The method of cleaning a wheel comprising the steps set forth in claims 64 and 65 wherein wheel comprises aluminum, chrome, stainless steel, painted steel, painted aluminum, clear coated aluminum, plastic, fiberglass, and rubber.

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Claim 73. A cleaning composition consisting essentially of:  
an effective amount of a dirt complexing polymer selected  
from the group consisting of a polyvinylpyrrolidone, a poly(4-  
vinylpyridine-betaine), a poly(N-vinylimidazole, a poly(4-  
5 vinylpyridine-N-oxide), and combinations thereof; and  
an effective amount of at least one surfactant.

Claim 74. A cleaning composition, consisting essentially  
of an effective amount of:

10 a dirt complexing polymer selected from the group consisting  
of a polyvinylpyrrolidone, a poly(4-vinylpyridine-betaine), a  
poly(N-vinylimidazole, a poly(4-vinylpyridine-N-oxide), and  
combinations thereof;

15 an effective amount of at least one surfactant;  
an effective amount of at least one scouring agent;  
and water.

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/35393

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : C11D 3/28  
US CL : 510/189, 245, 254, 365, 500

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
U.S. : 510/189, 245, 254, 365, 500

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
West search: PVP, polyvinylpyrrolidone, carwash

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,955,415 A (GUTIERREZ et al) 21 September 1999 (21.09.1999), col. 44, line 59 and col. 51, lines 20-45.	1-74
X	US 6,106,828 A (BISGARD-FRANTZEN et al) 22 August 2000 (22.08.2000), col. 12, examples 2-8 and col. 32, line 14.	1-74
X	US 4,348,292 A (GINN) 07 September 1982 (07.09.1982), col. 2, line 31 and col. 5, example III.	1-74



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents:

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